

TREK DATA TUTORIAL



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Approved for Public Release; Distribution is Unlimited.

TABLE OF CONTENTS

<u>PARAGRAPH</u>	<u>PAGE</u>
1 Welcome.....	1
2 Technical Support.....	1
3 Introduction.....	1
4 Overview of the User Interface	2
4.1 Main Window.....	2
4.2 Menus.....	3
5 TReK Data Tour	5
5.1 Step-By-Step	5

FIGURES

<u>FIGURE</u>	<u>PAGE</u>
Figure 1 Main Window	3
Figure 2 Service Menu Context Specific Menu Items.....	4
Figure 3 TReK Data Main Window	6
Figure 4 Add Service Dialog.....	7
Figure 5 Service Name Populated	8
Figure 6 Data Description Tab	9
Figure 7 TrekCcsds.7 Packet in Packet List	10
Figure 8 Process Tab	11
Figure 9 Processing Tab with Processing On	12
Figure 10 Record Tab.....	13
Figure 11 Record Tab with Recording On	14
Figure 12 Record Tab Populated	15
Figure 13 Packet 7 in the Data Main Window	16
Figure 14 Packet 7 Activated.....	17
Figure 15 Displays Dialog.....	17
Figure 16 TrekCcsds.7 Packet Display.....	18
Figure 17 Generator Main Window.....	18
Figure 18 Generator Add Service Dialog	19
Figure 19 Add Service Dialog Generate Tab (Packet 7)	20
Figure 20 Configure Generator Properties Dialog.....	20
Figure 21 Add Service Dialog Generate Tab	21
Figure 22 Generator Add Service Dialog Forward Tab.....	22
Figure 23 Generator Main Window with Packet 7	22
Figure 24 Generator Main Window Activated Service	23
Figure 25 Generator Sending Packet 7	24
Figure 26 TReK Data Receiving Packet 7 Data	24
Figure 27 TrekCcsds.7 Packet Data Values	25
Figure 28 TrekCcsds.7 Display with Stale Data.....	26

1 Welcome

The Telescience Resource Kit (TReK) is a suite of software applications and libraries that can be used to monitor and control assets in space or on the ground.

The TReK Data application provides the capability to manage data services such as receiving data, processing data, recording data, forwarding data, and displaying data.

This tutorial provides step-by-step instructions describing how to perform common application functions.

The topics in this tutorial require an understanding of the topics covered in the TReK Concepts document. Please be sure you have read the TReK Concepts document before proceeding with this tutorial.

This tutorial uses screen dumps taken on a Windows computer. However, the steps are the same regardless of whether you are running on Windows or Linux.

2 Technical Support

If you are having trouble installing the TReK software or using any of the TReK software, please contact us for technical assistance:

E-Mail: trek.help@nasa.gov

Messages sent to this address are automatically forwarded to the TReK team.

The HOSC Help Desk (256-544-5066) can provide assistance as needed and is available 24x7.

3 Introduction

The TReK Data application provides the capability to manage data services such as receiving data, processing data, recording data, forwarding data, and displaying data. It can be configured to receive different types of data from multiple sources simultaneously. The configuration can be saved.

The Data application creates a TReK data store on application initialization. The data store is used by the application to store incoming data so it can be accessed using the TReK Telemetry Application Programming Interface (API). When using the TReK Telemetry API, you will need the data store name. The Data application uses "DefaultDataStore" as the default data store name. If you start another instance of the TReK Data application, and the "DefaultDataStore" name is already in use, the

application will prompt you to enter a new and unique name. There is also an option within the application to change the data store name.

4 Overview of the User Interface

4.1 Main Window

The main window consists of three main areas as shown in Figure 1. The top part of the main window contains the list of services. A Service is used to define a set of functions to perform. When you start the Data application the list will be empty. The middle part of the window is the Statistics area. Once you activate one or more services, the Statistics area will display statistics information about each service. It will also provide information about the functions being performed like how many packets were recorded, how many packets were forwarded, etc. The Statistics area can be reconfigured to show several different views. The bottom part of the window is a message area that is used to display important status and information messages about the activities in progress.

You may have noticed that each service row has a color associated with it. The color provides information about the service. For example, when using the default colors, if the packet row is black, this indicates that the packet has not been activated. If the packet row is purple, this indicates that the service is initializing. If the packet row is blue, this indicates the packet has been activated but no data has arrived. If the packet row is green, this indicates that data packets are arriving. The colors are helpful in providing immediate information about the general configuration and status of each service in the list.

Figure 1 shows two services in the Service area. The first service in the list is named **Science Data**. The Science Data service is configured to receive a data stream containing science data. The status is Active and the color is green to indicate that data is arriving. The second service in the list is named Health and Status Data. The status is Inactive and the color is black. This indicates that the service has been configured but not activated. Until the service is active, the Data application is not prepared to handle the incoming data. When a service is activated, it creates all the network sockets and other support needed to support the services requested. As soon as a service goes Active, the application will start applying the configured services to support any data that arrives (processing, recording, etc.).

The Statistics area and the Message Area are dock windows that you can float or dock. To float a dock window, use your left mouse button to click and hold the title area while dragging the window to another area of the screen. To dock, use the title bar to drag the dock window over the main window and drop.

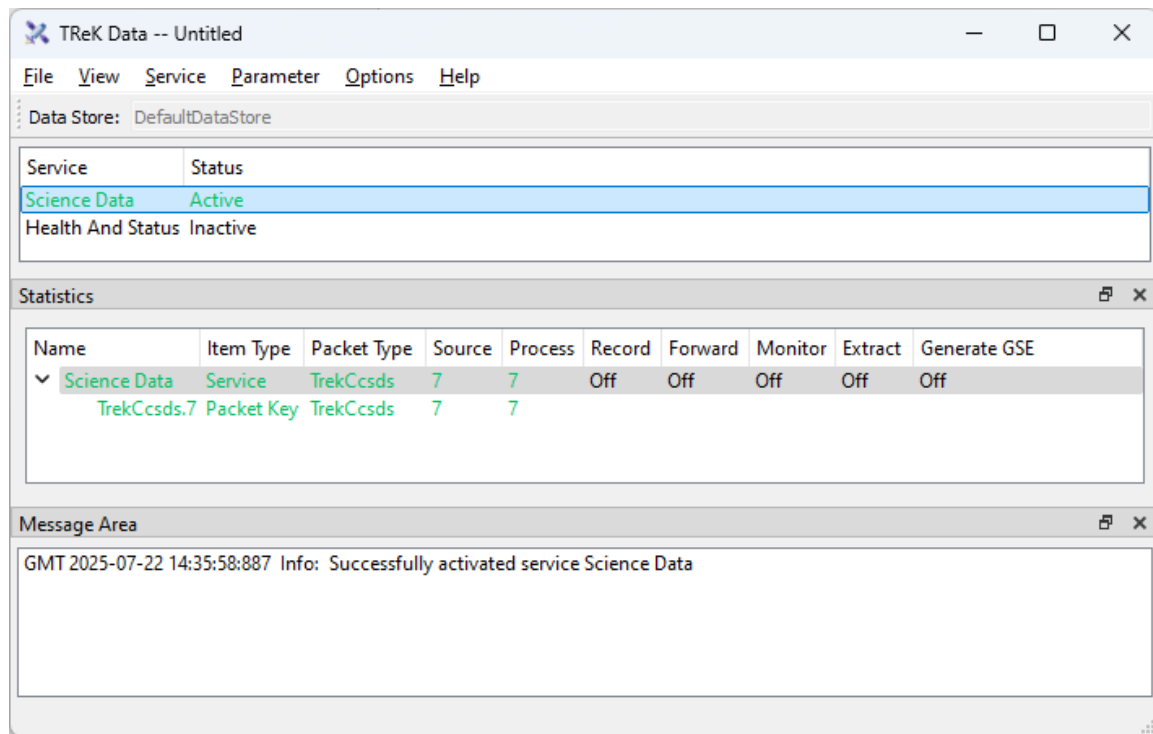


Figure 1 Main Window

Data Store Toolbar

The Data Store toolbar displays the name of the data store created by the application.

Service Area

The Service area provides a list of “Services”. A Service defines a set of functions to perform.

Statistics Area

The Statistics area provides real time statistics information for active services.

Message Area

The Message Area displays important information, warning and error messages. The message area can be cleared using the View menu.

4.2 Menus

The application menus are: File, View, Service, Parameter, Options, and Help. Each of these menus is described in more detail below.

File Menu

The File menu provides the capability to create a new configuration, open a configuration, save a configuration, and exit the application.

View Menu

The View menu provides the capability to clear the main window message area and show and hide the main window statistics and message area.

Service Menu

The Service menu provides the capability to perform functions associated with services such as adding a service, activating a service, or deleting a service. The service menu also shows context dependent menu items corresponding to the configuration of the service. The context menu items will only appear when the service is active. For example, in Figure 2 there is a service selected that is configured to record data. Therefore, when the service is active and selected there will be additional service menu items to control recording.

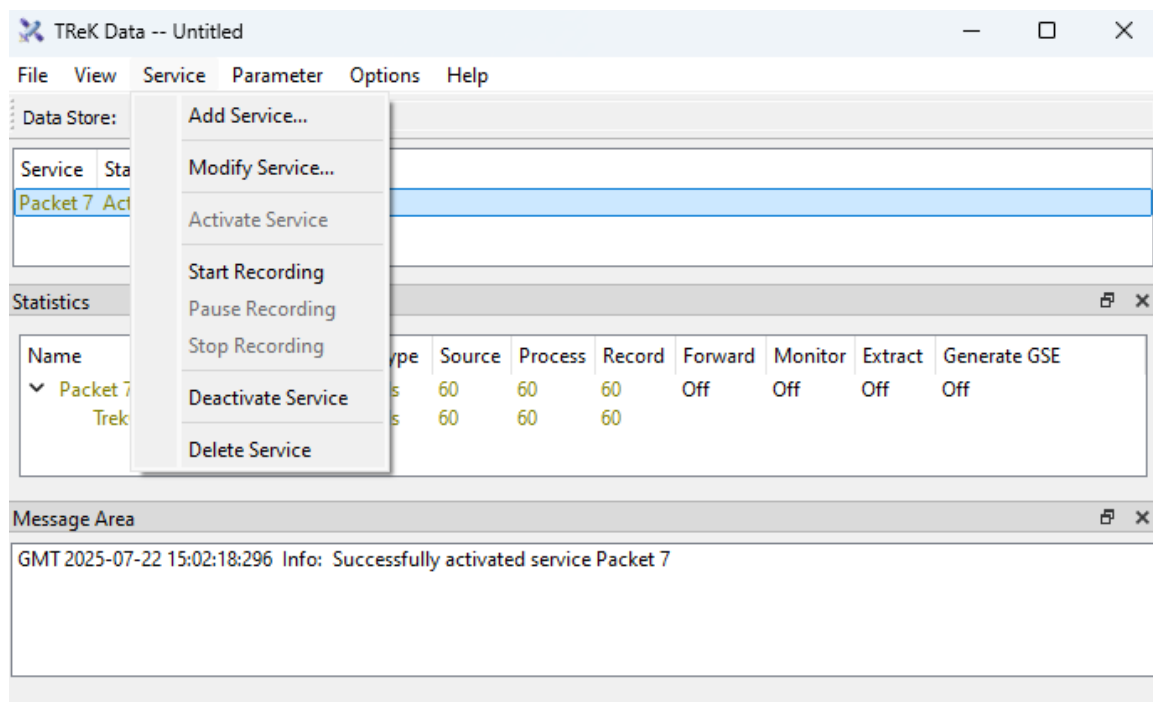


Figure 2 Service Menu Context Specific Menu Items

Parameter Menu

The Parameter menu provides access to parameter type capabilities such as displays and parameter monitoring.

Options Menu

The Options menu provides the capability to access statistics, reset statistics, configure statistics snapshot recording, and change the data store. It also provides access to the Messages dialog which can be used to display and filter application messages.

Help Menu

The Help menu provides access to on-line help and application version information.

5 TReK Data Tour

Sometimes it's easier to learn how to use an application by example. This section describes how to use the Data application to receive, process, record, and display incoming data.

This section was written assuming you have read the Introduction section and the Main Window section. If you have not read these sections, please go back and read them. They contain important information that is not repeated in this section.

If at any time you need to exit the application so you can resume working through the Tutorial at a later time, File Save will allow you to save all the data you entered.

Please go through the tour in order. Some sections depend on data from previous sections.

5.1 Step-By-Step

This section provides step-by-step instructions that show how to configure the Data application to receive an incoming data stream, process the incoming data, and display the data.

1. Go to the operating system's menu to start the **TReK Data** application. You should see the **TReK Data** main window shown in Figure 3.

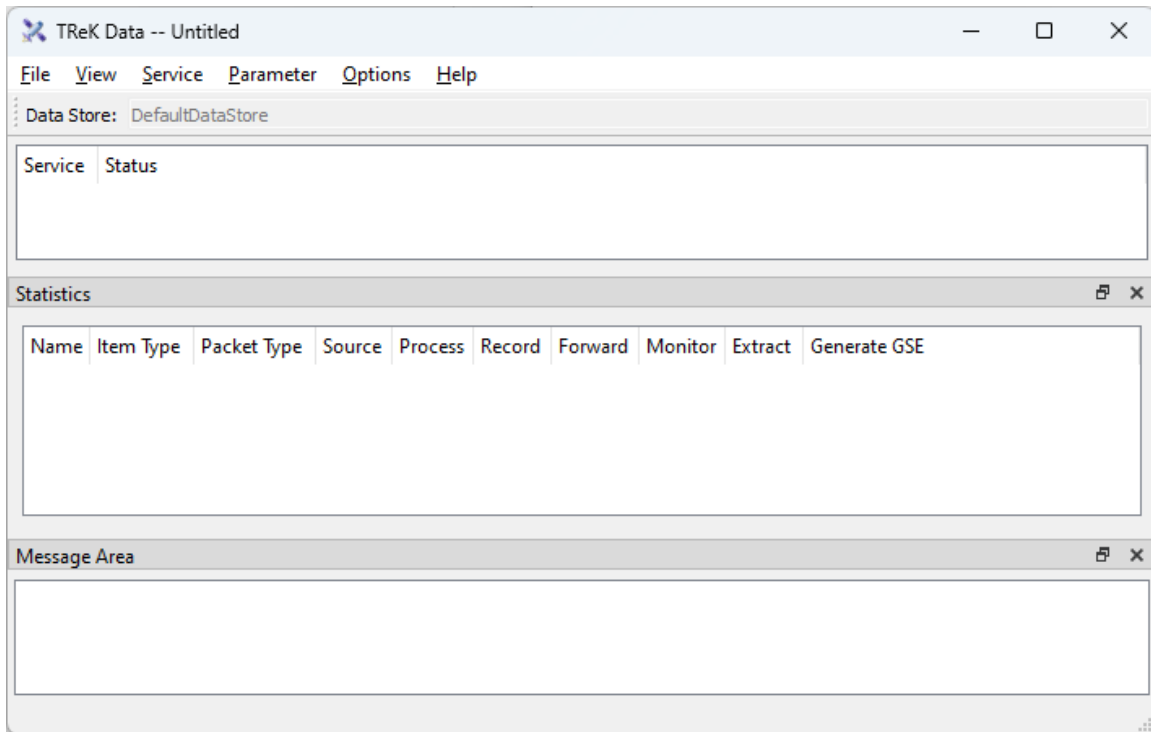


Figure 3 TReK Data Main Window

2. Go to the **Service** menu and select **Add Service**. You should see the dialog shown in Figure 4.

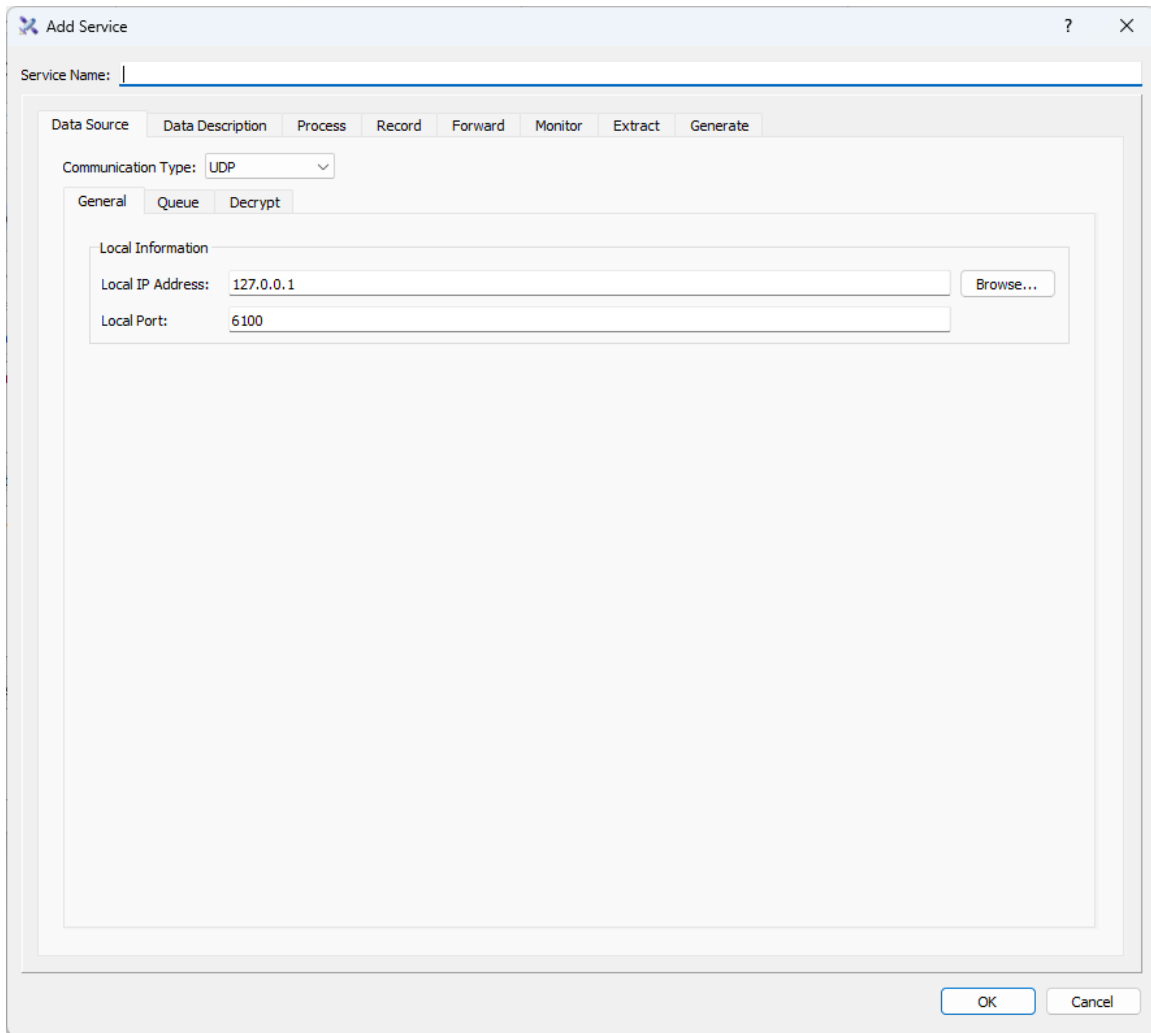


Figure 4 Add Service Dialog

3. In the **Add Service** dialog enter **Packet 7** in the **Service Name** field as shown in Figure 5. The **Local IP Address** should default to your local IP Address. But you need to check it to be sure. If it doesn't default to the right address, please enter your local IP address. All the other settings on this tab are set correctly.

The screenshot shows a Windows-style dialog box titled "Add Service". At the top, there is a text field for "Service Name" containing the text "Packet 7". Below this is a row of tabs: "Data Source", "Data Description", "Process", "Record", "Forward", "Monitor", "Extract", and "Generate". The "Data Source" tab is currently selected. Under the "Data Source" tab, there is a "Communication Type" dropdown menu set to "UDP". Below that are three sub-tabs: "General", "Queue", and "Decrypt". The "General" sub-tab is selected. In the "General" sub-tab, there is a section titled "Local Information" which contains two text fields: "Local IP Address" with the value "127.0.0.1" and a "Browse..." button to its right, and "Local Port" with the value "6100". At the bottom right of the dialog box are "OK" and "Cancel" buttons.

Figure 5 Service Name Populated

4. Select the Data Description tab as shown in Figure 6.

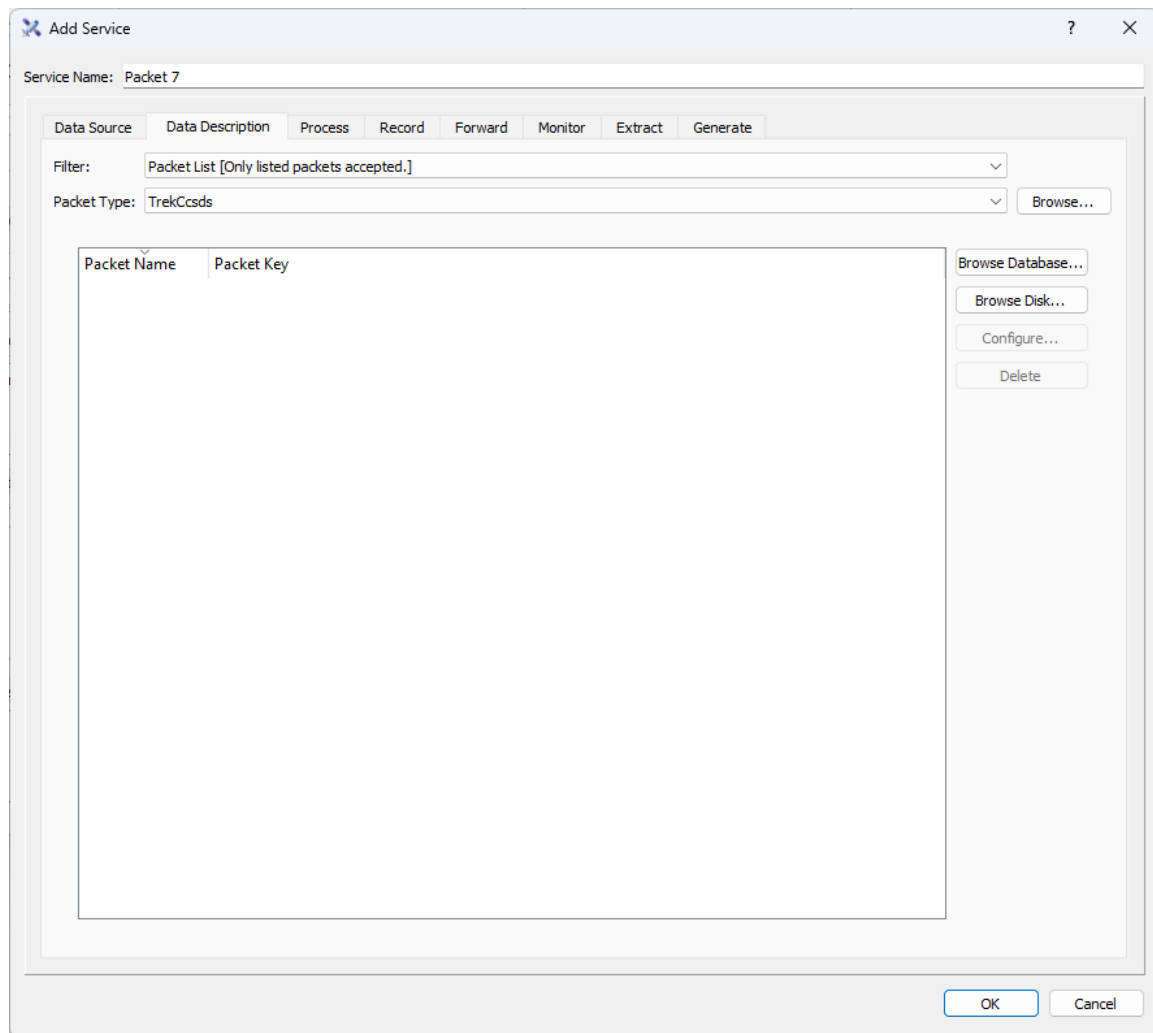


Figure 6 Data Description Tab

5. The Filter should be set to Packet List as shown. The Packet Type shown could be different on your system. If necessary, change the Packet Type to TrekCcsds. Push the Browse Disk... button to select and add a packet to the packet list. The packet information will be added by selecting a metadata file in the Open dialog. The Open dialog will be displayed when you push the Browse Disk dialog and should default to the `trek_workspace\metadata\telemetry_packet` folder in your home directory. Select the file named 'trek_ccsds_7.xml' and push the Open button to add this packet to the list. The dialog should look like the one shown in Figure 7. This step configures the service to identify and filter packets that are TREK CCSDS packets and an APID value of 7.

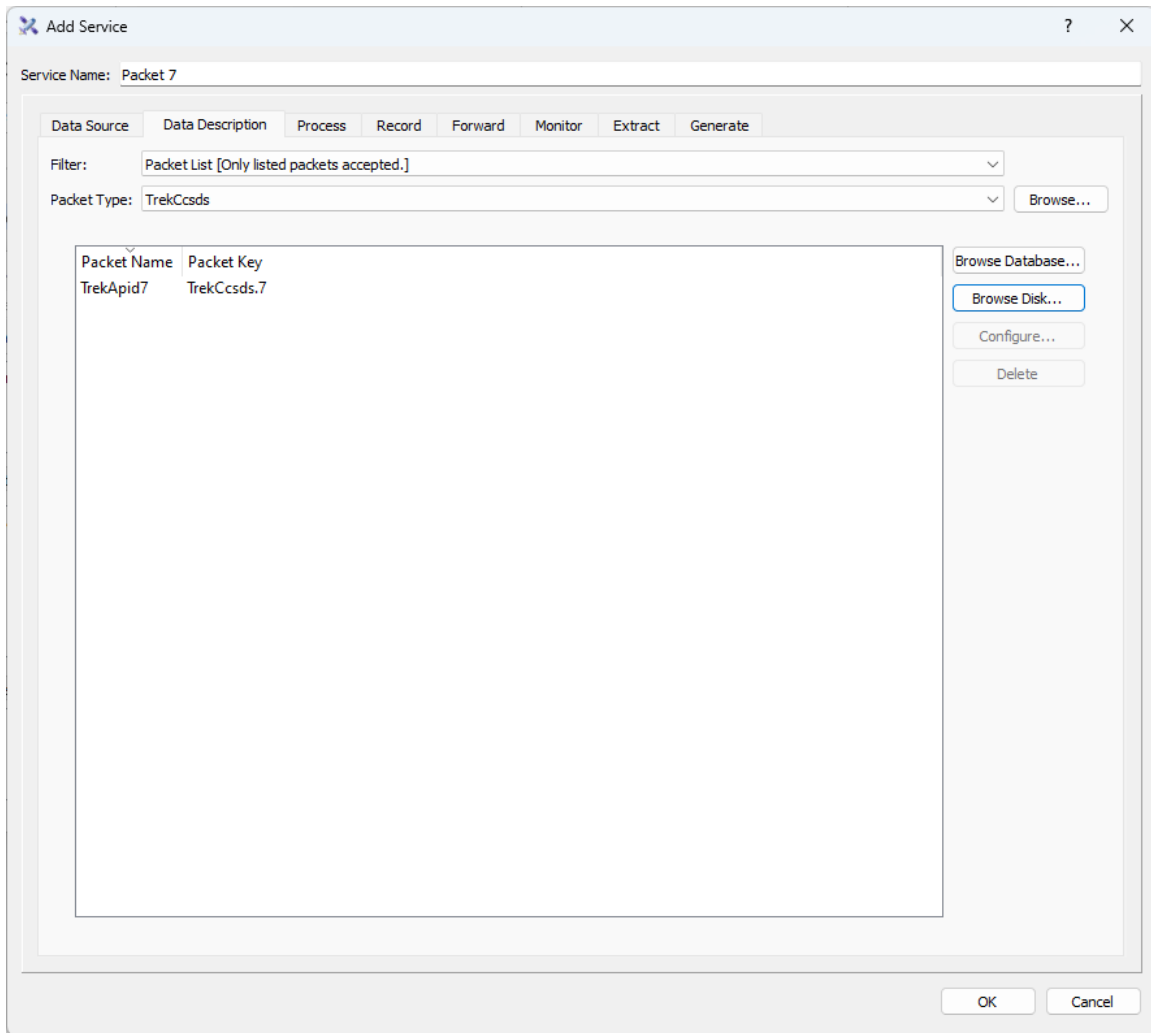


Figure 7 TrekCcsds.7 Packet in Packet List

6. Select the Process tab. Your Process tab should look similar to the one shown in Figure 8.

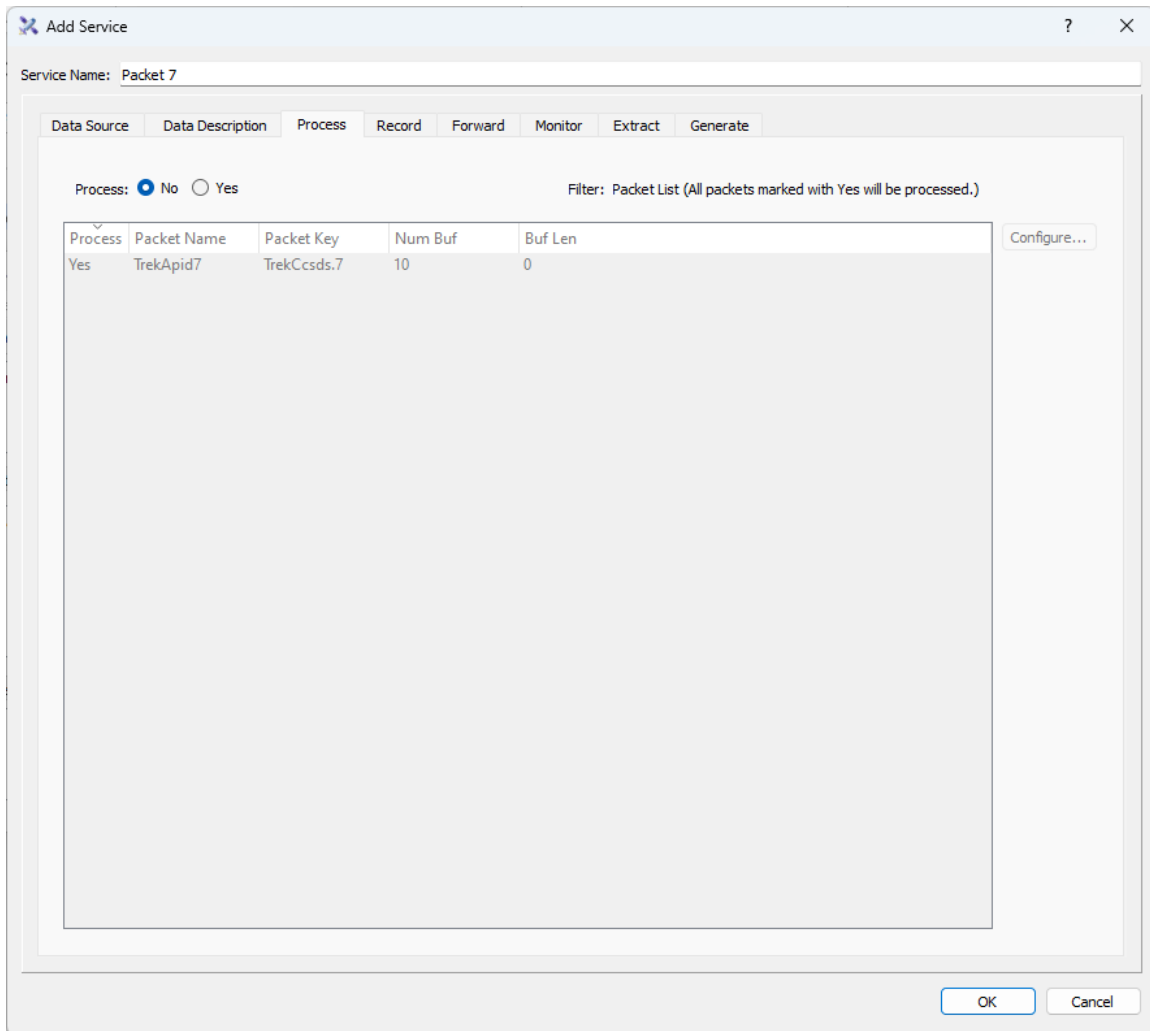


Figure 8 Process Tab

7. In the Process Tab, select the Yes radio button to indicate the incoming data should be processed. You can see that the Packet List already contains the packet you added on the Data Description tab. Figure 9 shows the configuration with processing on. It also shows the number of buffers that will be used to store the incoming data for TrekCcsds.7 defaults to 10 and the buffer length defaults to 0. A value of 0 indicates the length should be calculated using information in the packet definition. If you needed to change these values, they can be changed using the Configure button. They are fine as is for this tutorial.

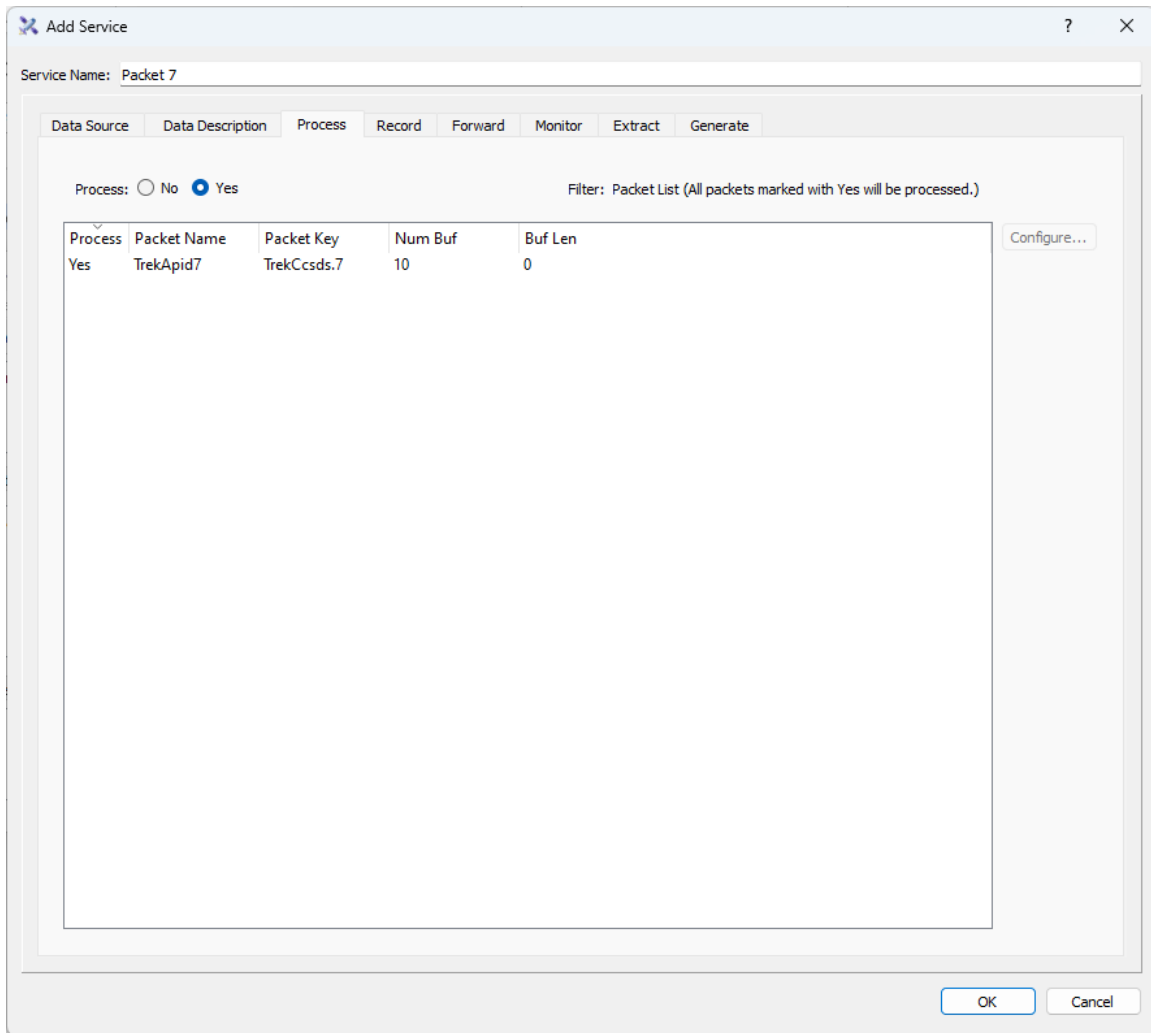


Figure 9 Processing Tab with Processing On

8. Select the Record tab. Your Record tab should look similar to the one shown in Figure 10.

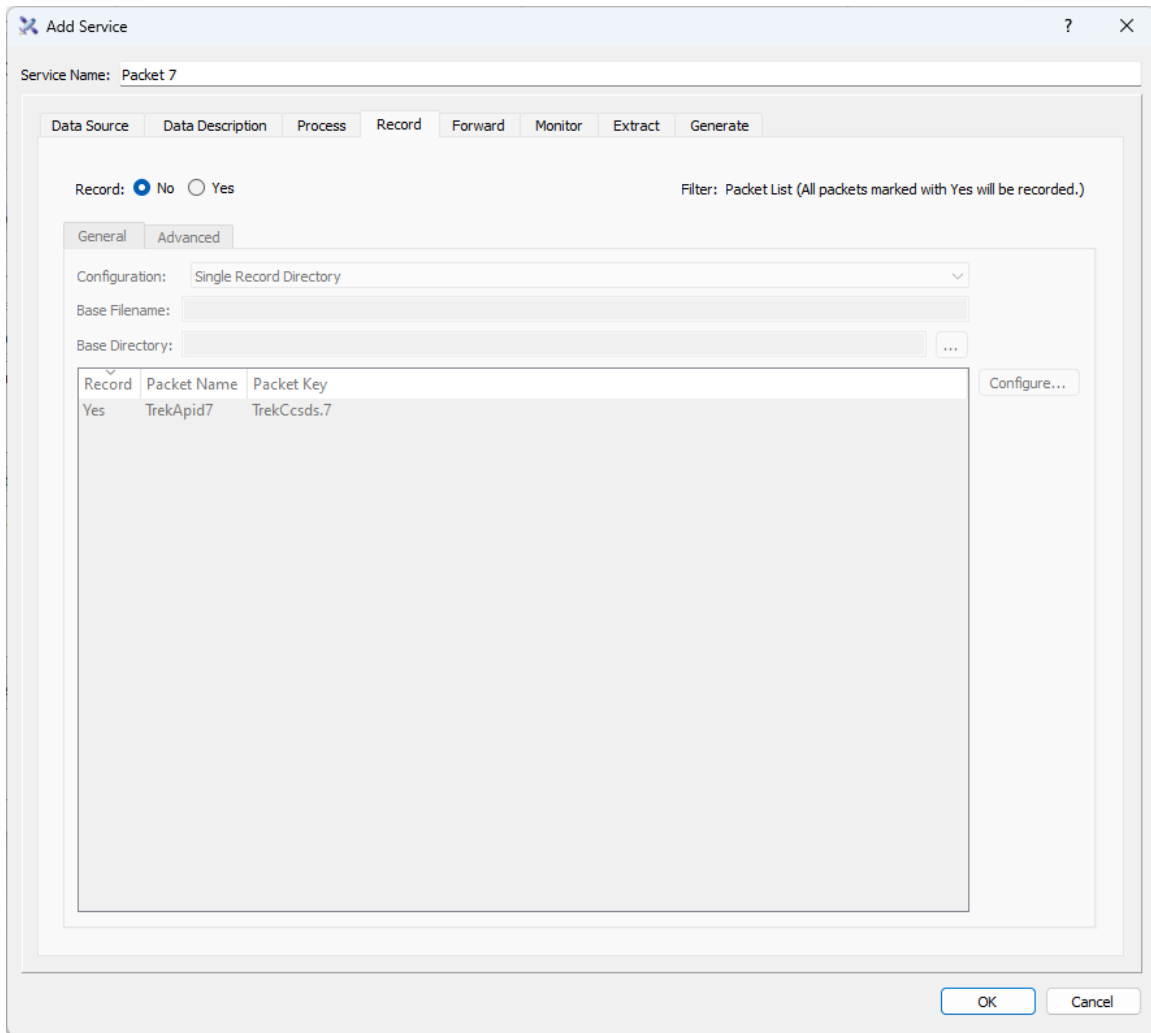


Figure 10 Record Tab

9. In the Record Tab, select the Yes radio button to indicate the incoming data should be recorded. You can see that the Packet List already contains the packet you added on the Data Description tab. Figure 11 shows the configuration with recording on.

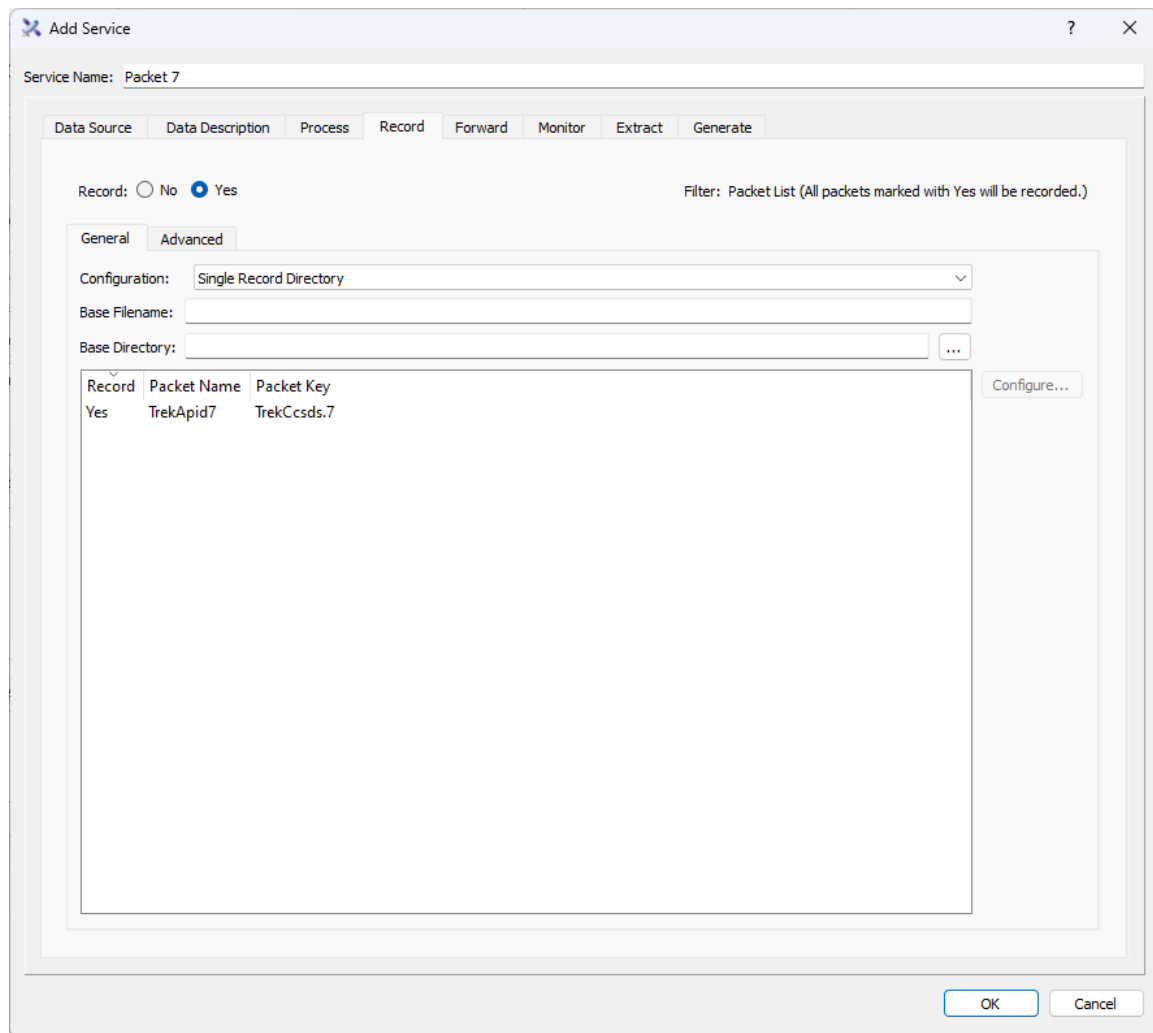


Figure 11 Record Tab with Recording On

Base Filename is used for part of the filename and the rest of the filename is generated by the TReK software. The complete filename indicates the time the file was created and closed. When you want to play the data back, you will be asked to provide this Base Filename. Therefore, you should try to select a meaningful name that will be easy to remember and is closely associated with the data that you are recording. The Directory information is used to identify which directory should be used for the recorded data files. You can use the ... button to select a directory. The Open dialog will default to the `trek_workspace` recorded_data directory.

Enter the following settings as shown in Figure 12.

Configuration: Single Record Directory
 Base Filename: Packet 7
 Base Directory: <Home Directory>\trek_workspace\recorded_data

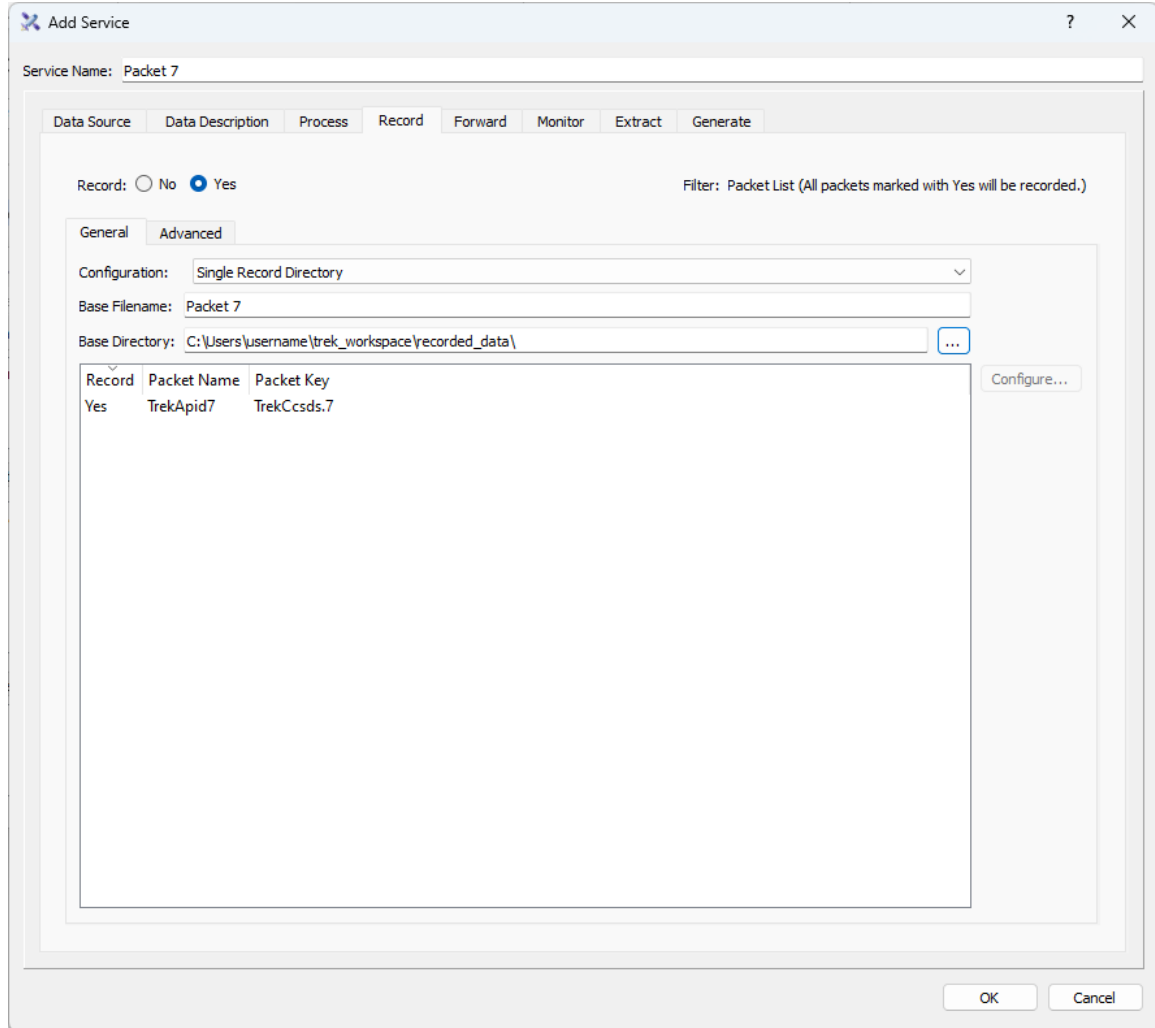


Figure 12 Record Tab Populated

10. Push the OK button in the **Add Service** dialog to close the dialog.
11. Select Packet 7 in the Main Window as shown in Figure 13.

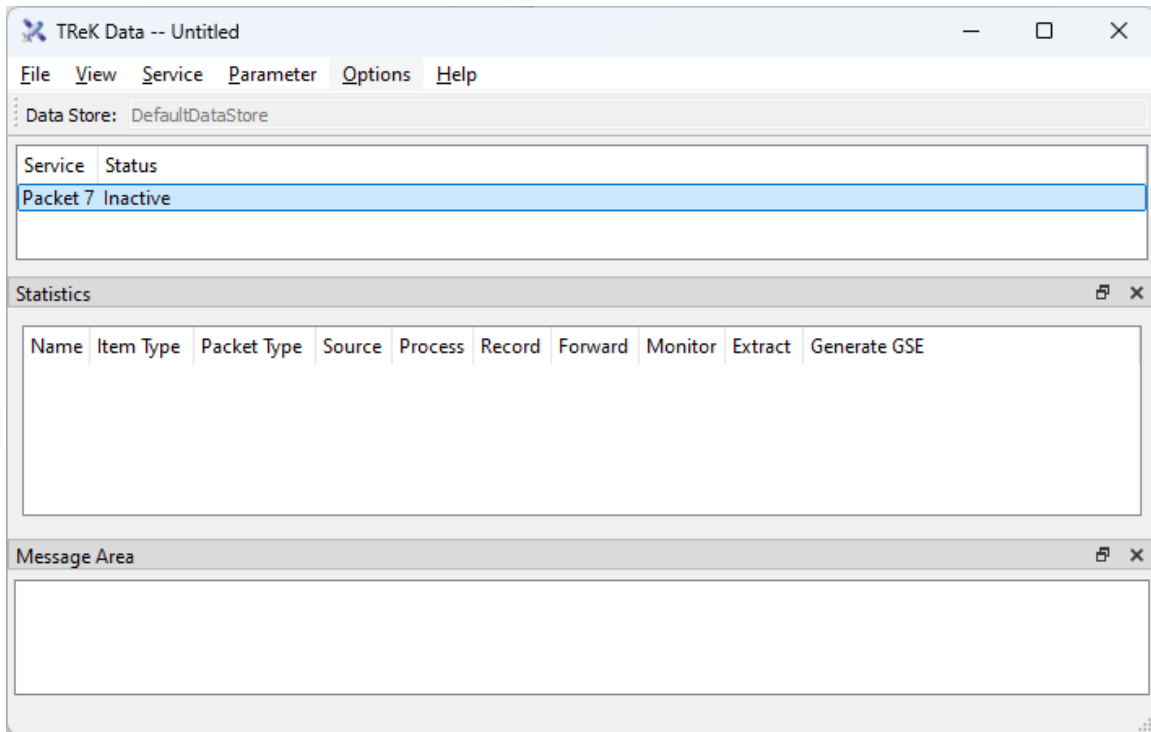


Figure 13 Packet 7 in the Data Main Window

12. With **Packet 7** selected, go to the **Service** menu and select **Activate Service**. Your Main Window should look like the one shown in Figure 14. Now you have everything configured to receive and process the packet.

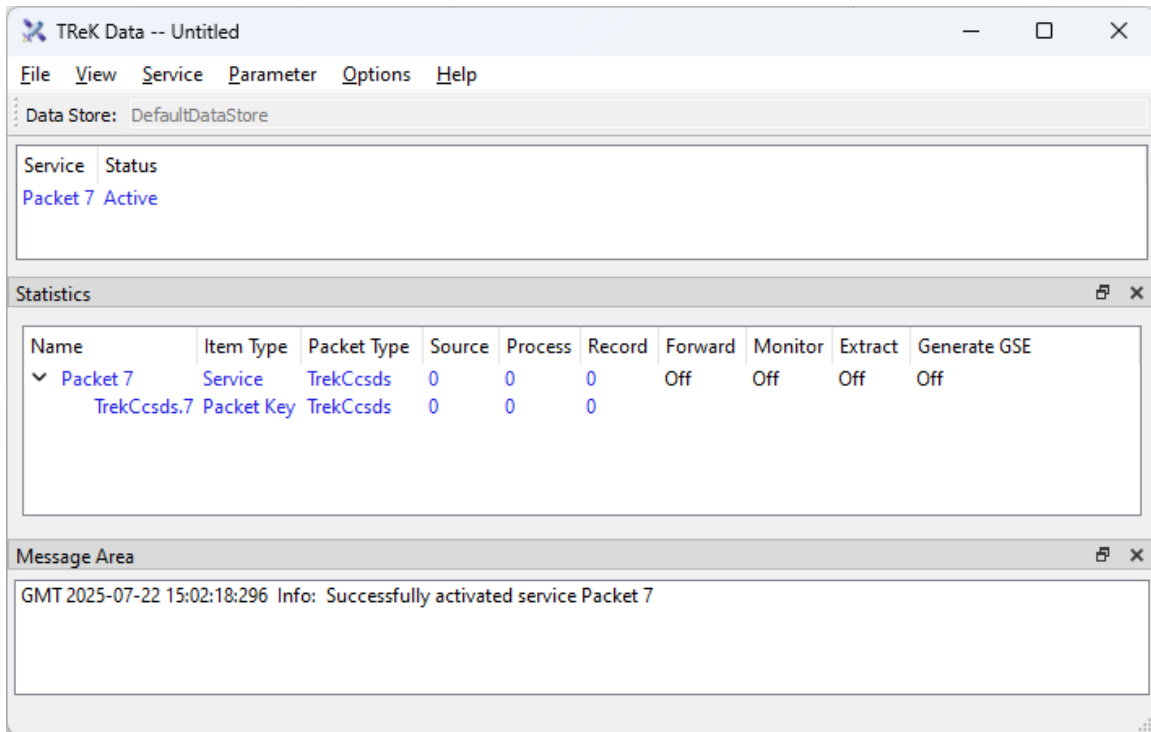


Figure 14 Packet 7 Activated

13. In the **Parameter** menu, select **Manage Displays**. You should see the dialog shown in Figure 15.

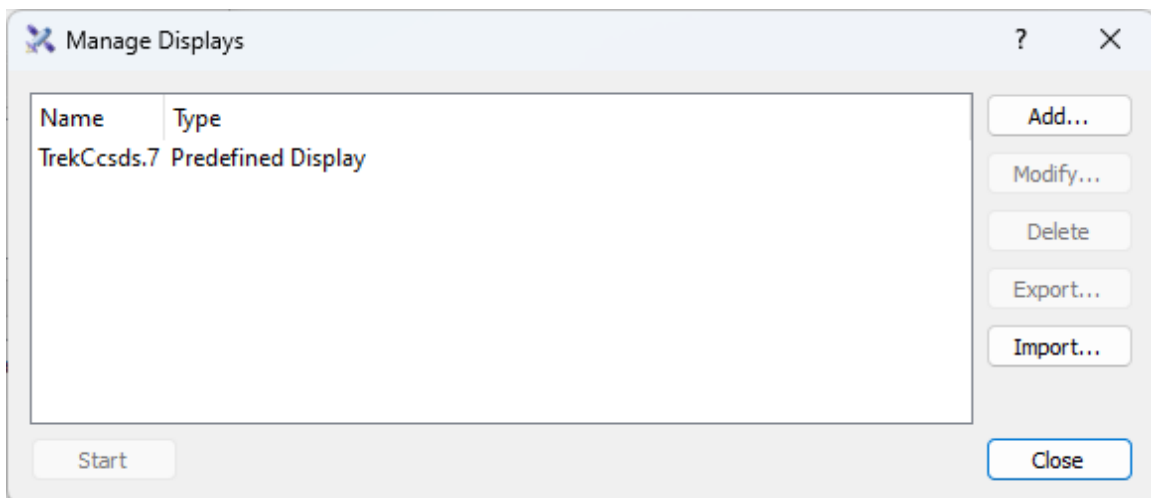


Figure 15 Displays Dialog

14. In the **Manage Displays** dialog, select **TrekCcsds.7** and push the **Start** button. You should see the dialog shown in Figure 16. Now you have a display to see the

processed data each time a packet is received. The Value and Status columns are empty because you have not received any data.

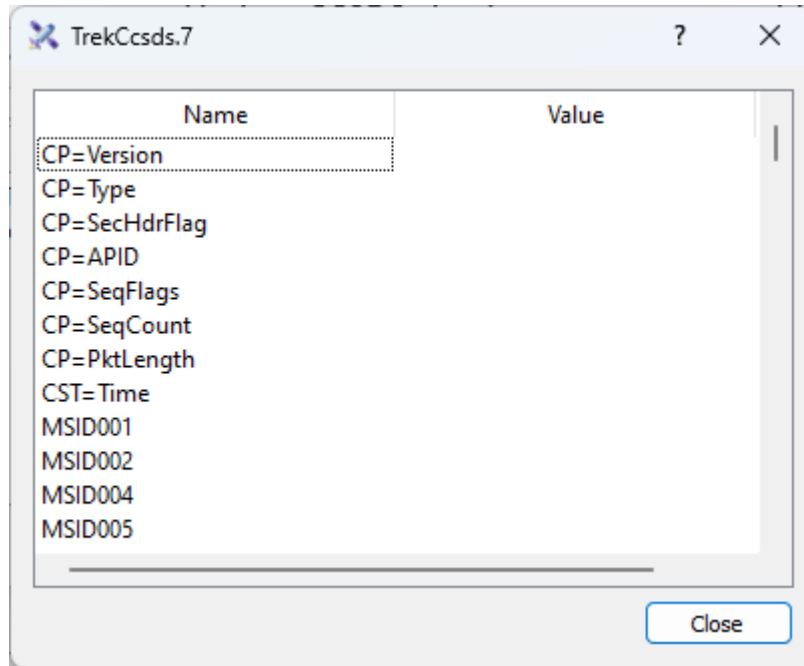


Figure 16 TrekCcsds.7 Packet Display

15. Now we need to flow some data. Go to the operating system's menu to start the **TReK Generator** application. You should see the Generator Main Window shown in Figure 17.

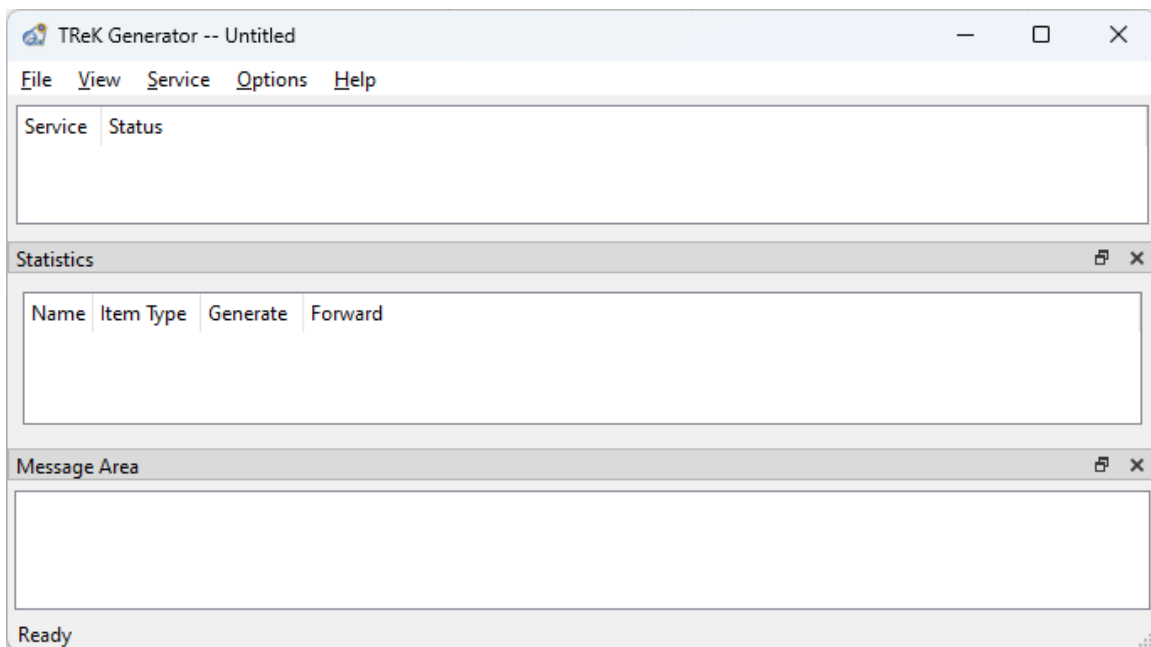


Figure 17 Generator Main Window

16. In the **Generator** application, go to the **Service** menu and select **Add Service**.
You should see the dialog shown in Figure 18.

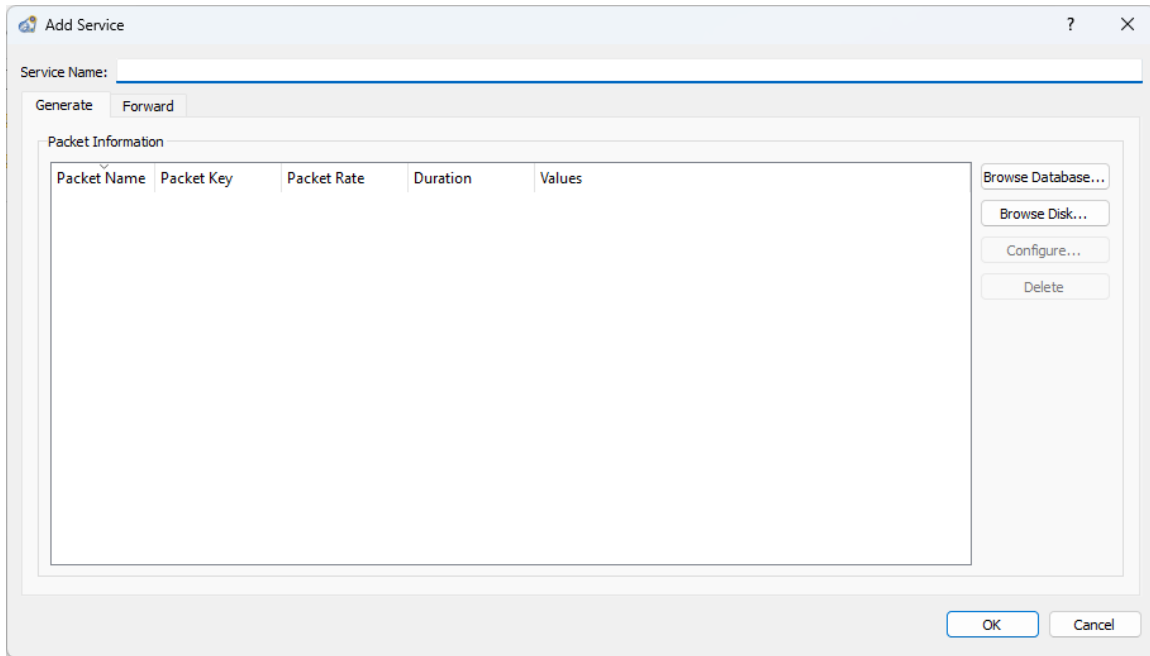


Figure 18 Generator Add Service Dialog

17. In the **Add Service** dialog enter **Packet 7** in the **Service Name** field.
18. On the **Generate** Tab select the **Browse Disk** button. In the Open dialog that is displayed choose the `trek_ccsds_7.xml` metadata file and push the OK button to add it to the list. The Generator application will use information in the metadata file to automatically generate data values for the packet contents. Your dialog should look similar to the one shown in Figure 19.

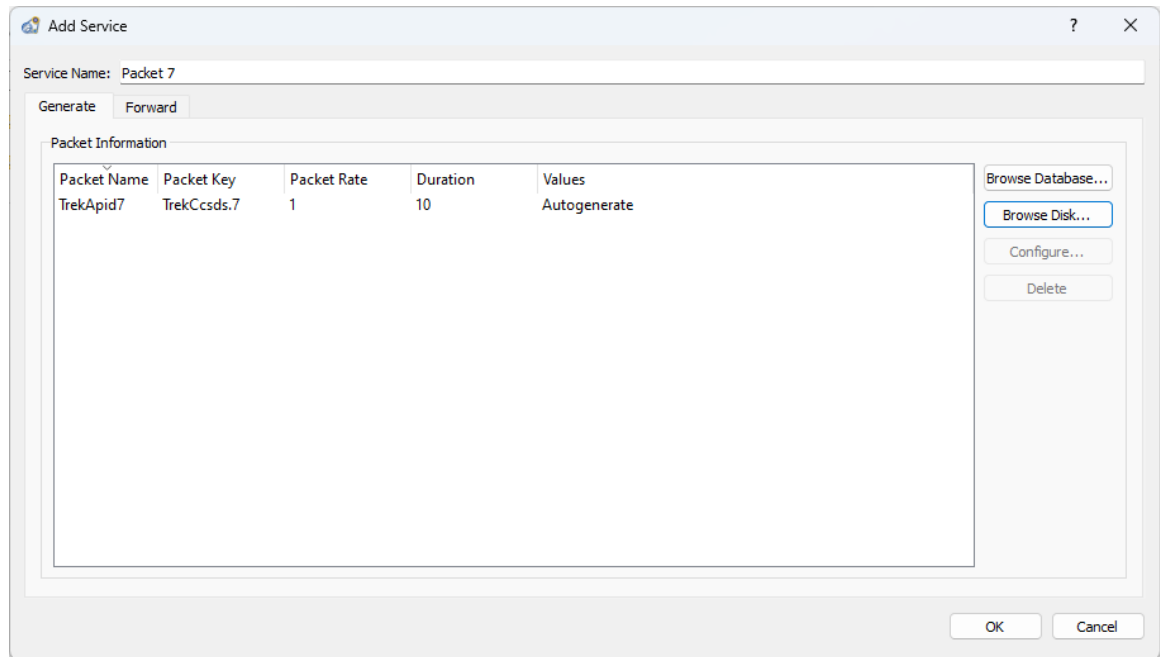


Figure 19 Add Service Dialog Generate Tab (Packet 7)

19. Select the packet in the list and push the **Configure** button. You should see the dialog in Figure 20.

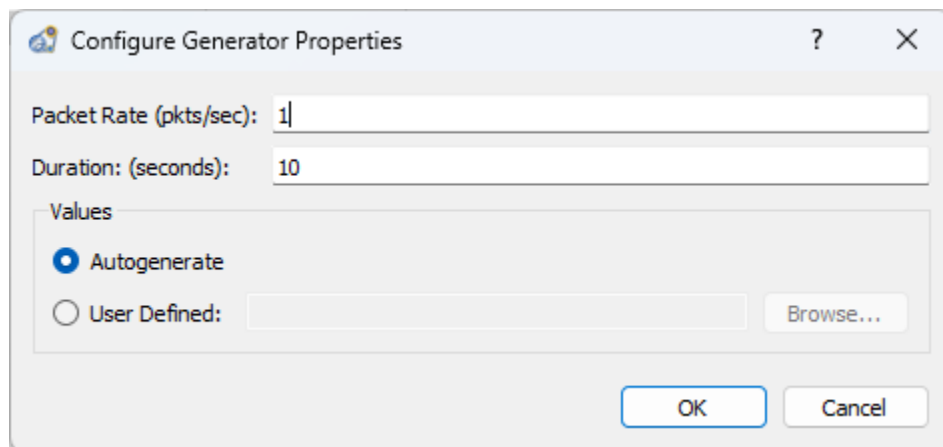


Figure 20 Configure Generator Properties Dialog

20. In the Configure Generator Properties dialog change the duration to 30. TReK can automatically generate data from your packet definition, but we'll use a predefined version with more interesting values. Select the User Defined radio button and use the **Browse...** button to select the TrekApid7.txt file. Push the **OK** button. You should see the duration has been set to 30 and the generator file that will be used in the Add Service dialog as shown in Figure 21.

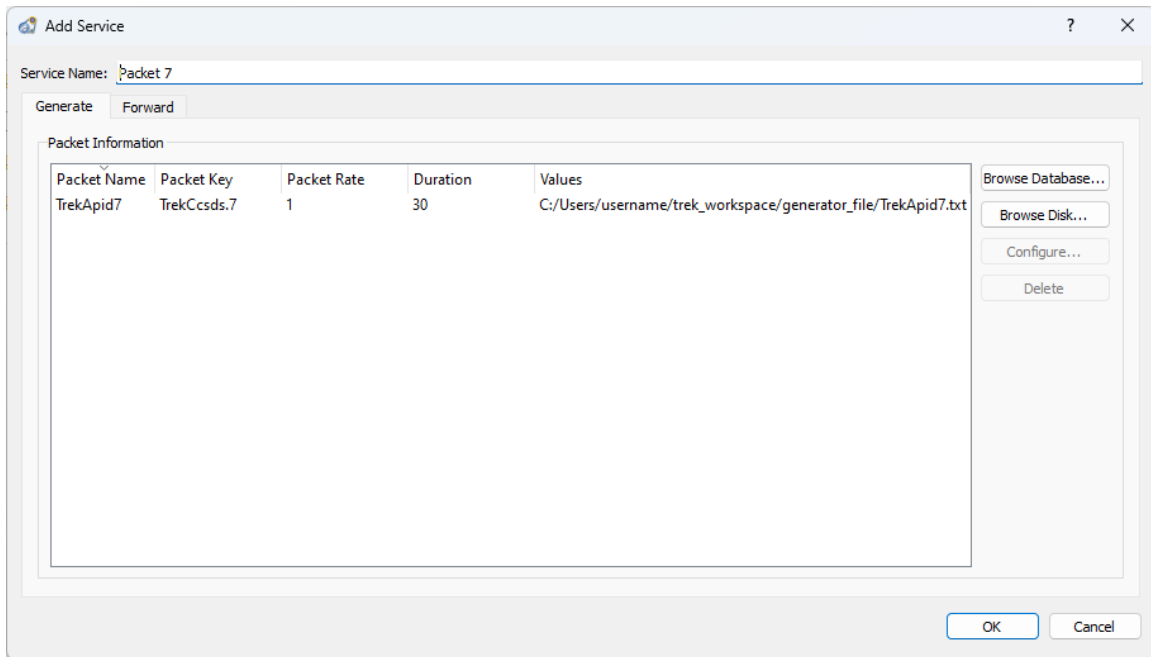


Figure 21 Add Service Dialog Generate Tab

21. Go to the **Forward** Tab. In the **Destination List Network Tab** push the **Add** button to add a row to the table. Enter the following information in the row to define a destination with details on where and how to forward the generated data:

Name	Data
Protocol	UDP
Destination IP Address	127.0.0.1
Destination Port Number	6100
Source IP Address	127.0.0.1
Source Port Number	0

22. Your dialog should look similar to the one shown in Figure 22. Push the **OK** button to add the service.

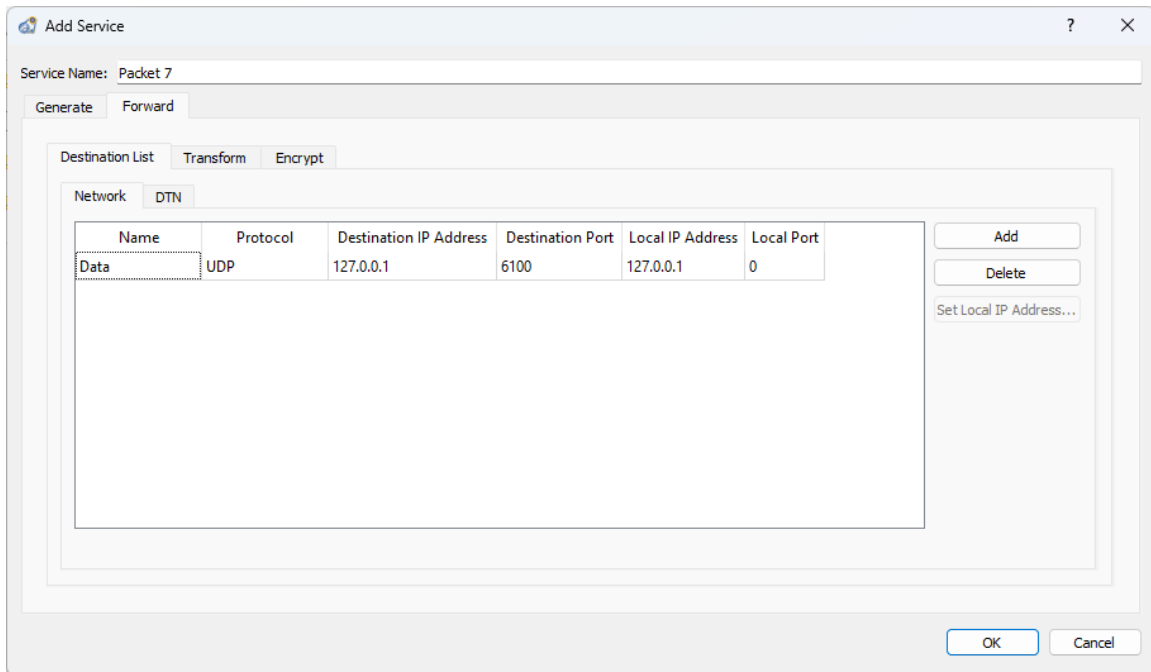


Figure 22 Generator Add Service Dialog Forward Tab

23. Your Main Window should look like the one shown in Figure 23.

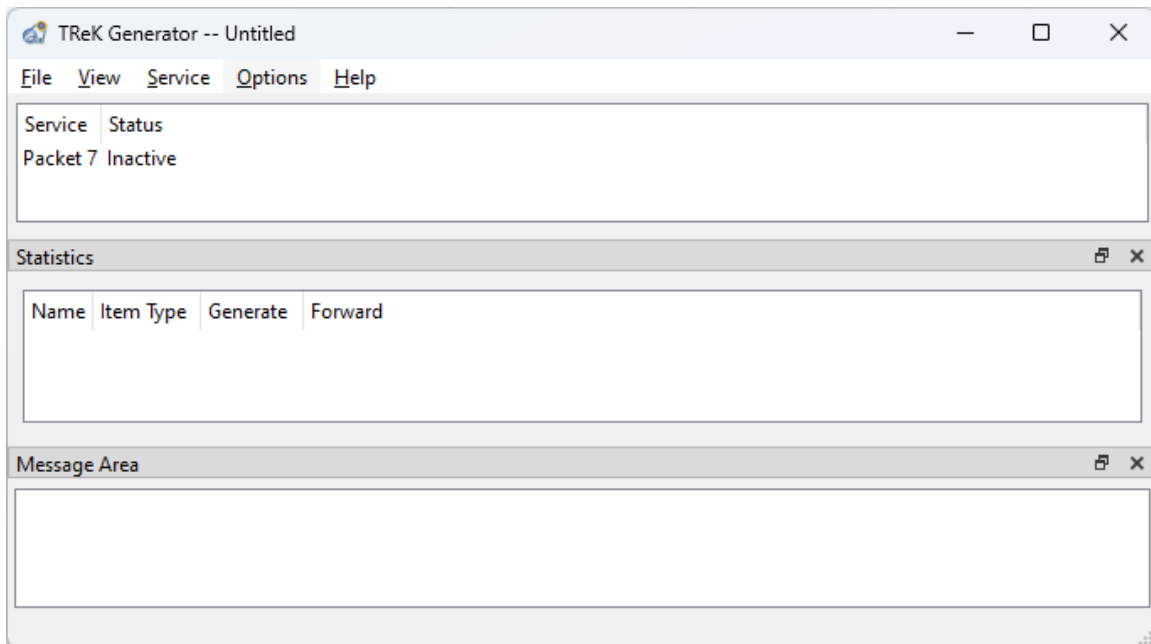


Figure 23 Generator Main Window with Packet 7

24. Now that you have identified the telemetry packet to send, you can activate the service. Select the packet in the main window and go to the **Service** menu and

select **Activate Service**. The service in the Generator will turn blue to indicate it is active and ready to generate data as shown in Figure 24.

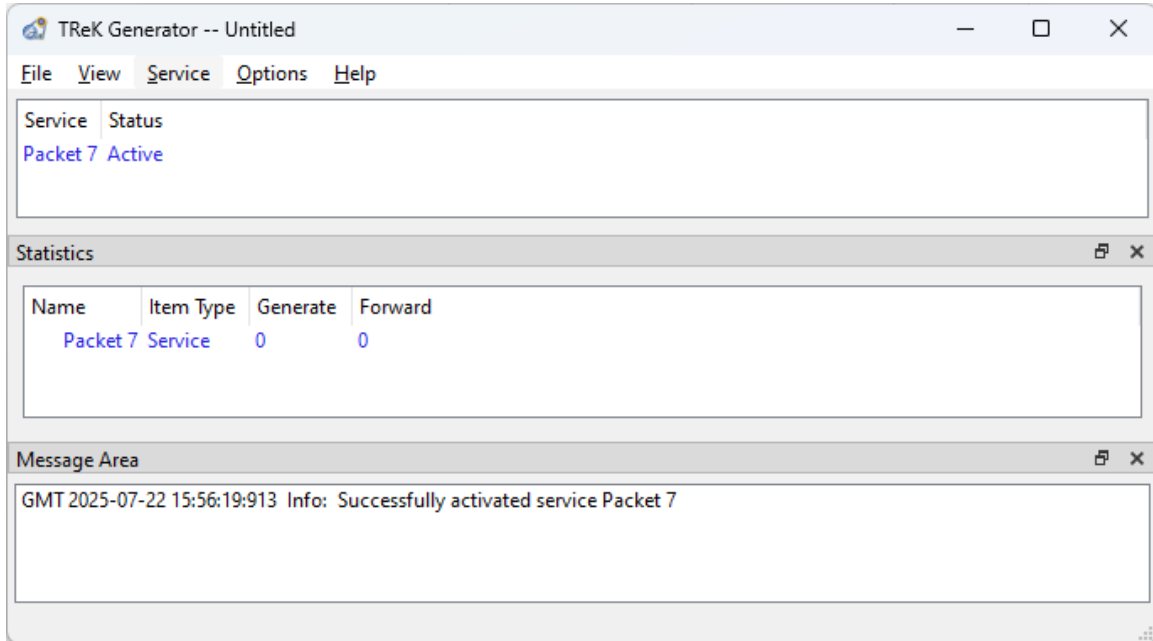


Figure 24 Generator Main Window Activated Service

25. Now that you have activated the service you can start the data flow. In the Generator main window select the packet and go to the **Service** menu and select **Start Packets**. The service in the Generator will turn green to indicate it is generating Packet 7 as shown in Figure 25.

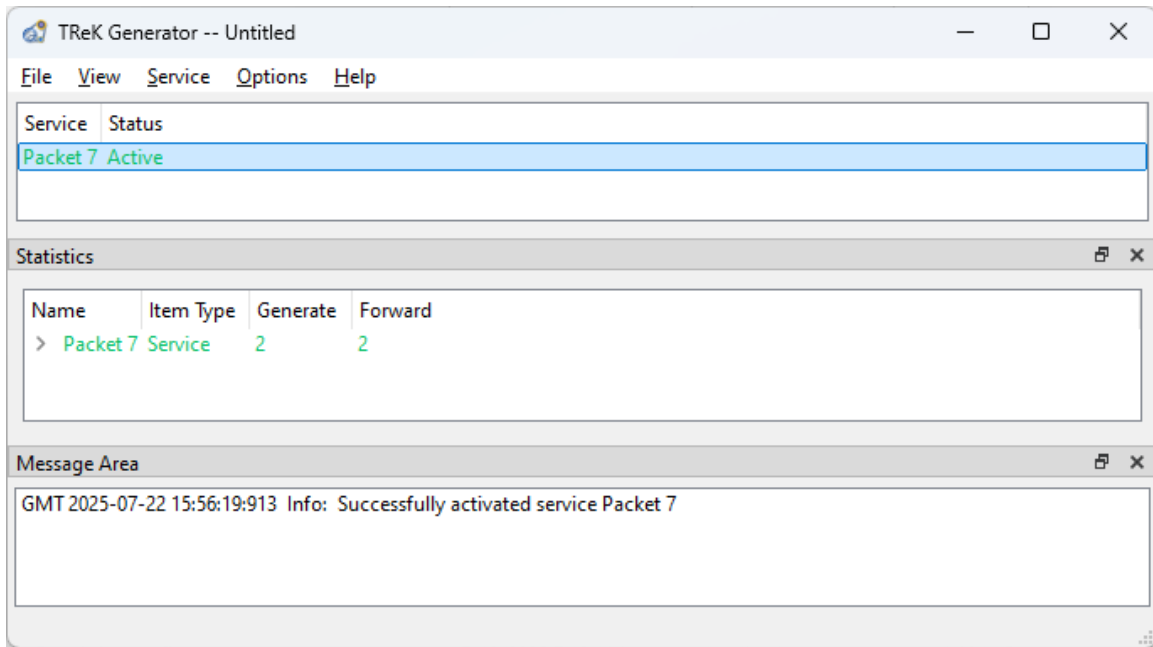


Figure 25 Generator Sending Packet 7

26. Look at the **TReK Data** Main Window. The service named **Packet 7** is green indicating it is receiving data as shown in Figure 26.

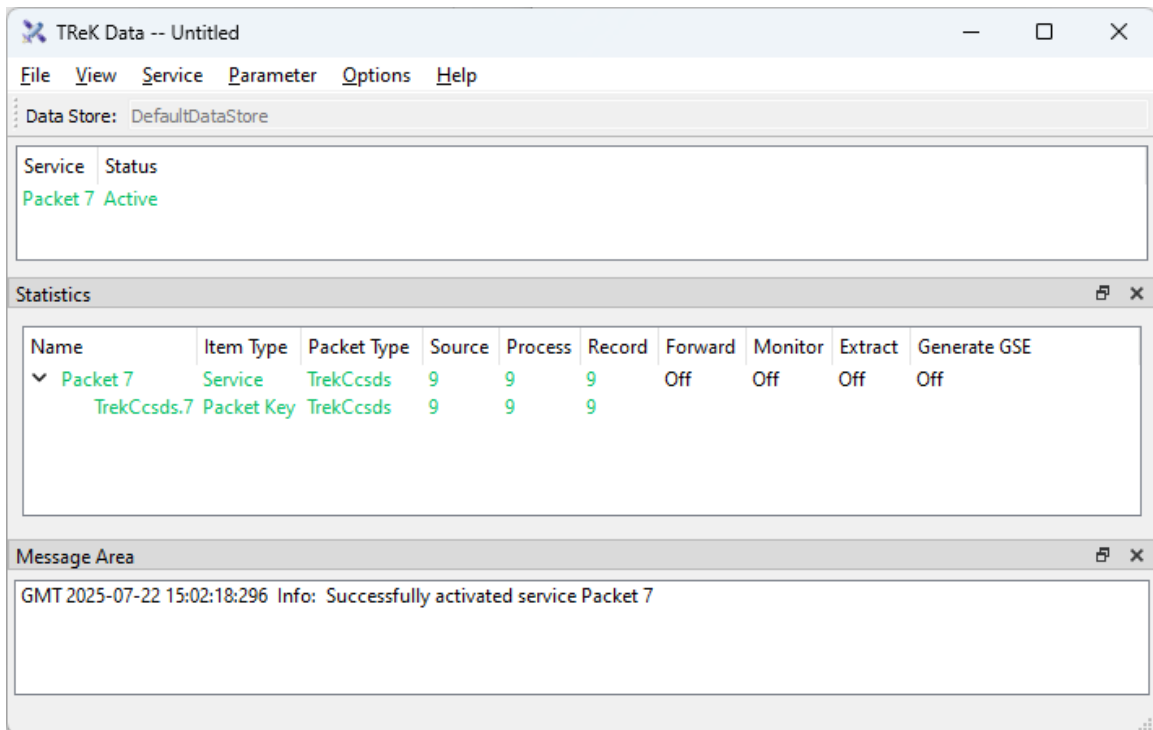
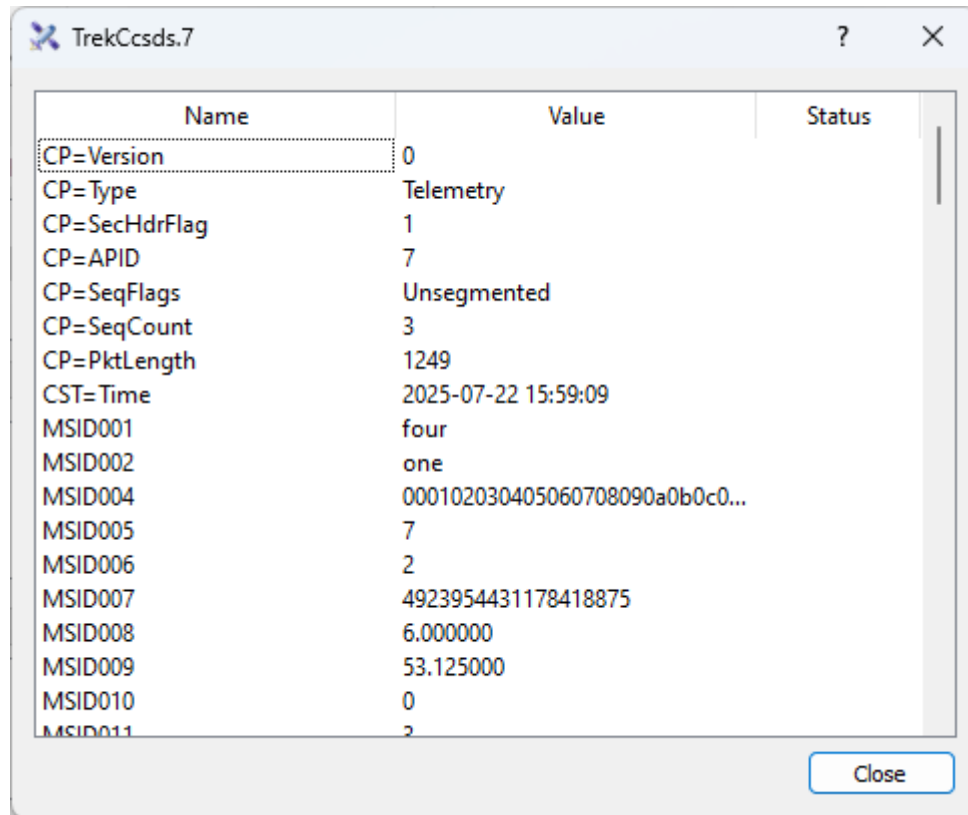


Figure 26 TReK Data Receiving Packet 7 Data

27. Look at the **TrekCcsds.7** display. The **Value** column should contain data values as shown in Figure 27. The data value of each parameter in the packet is displayed on the display each time a new packet of data arrives and is processed by the Data application. When you stop receiving data you will see the 'S' status character in the **Status** column to indicate the data is stale as shown in Figure 28.

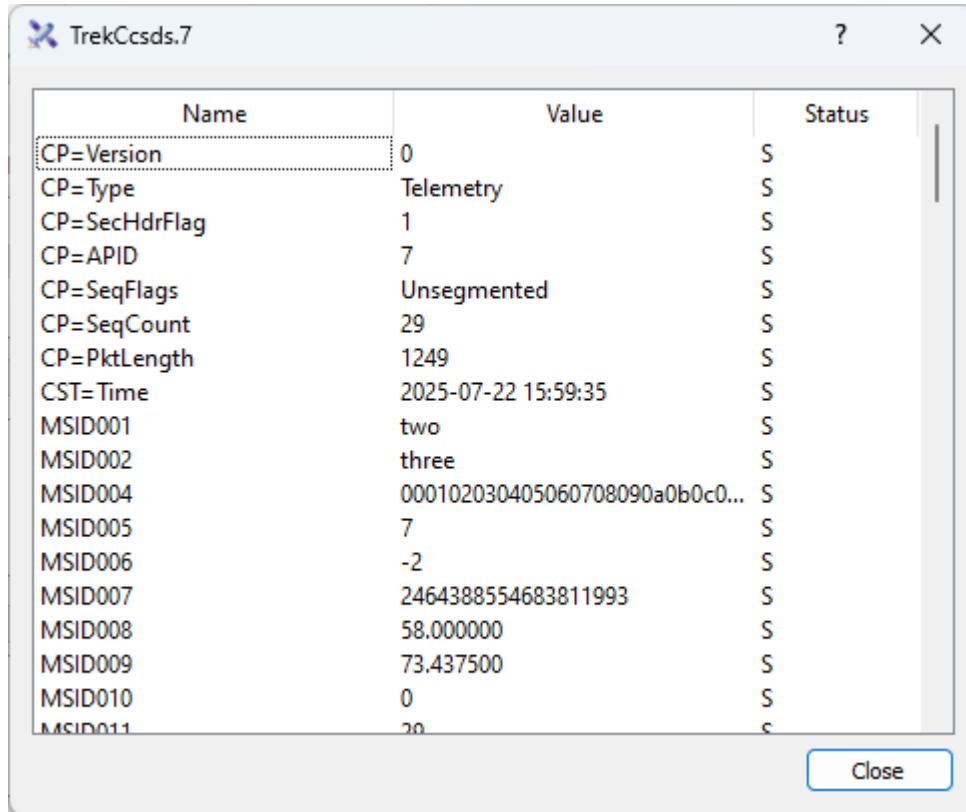


The screenshot shows a window titled "TrekCcsds.7" with a table of packet data. The table has three columns: "Name", "Value", and "Status". The "Status" column is currently empty. The "Name" column lists various parameters, and the "Value" column shows their corresponding data values. The "Status" column is currently empty, indicating that the data is not stale.

Name	Value	Status
CP=Version	0	
CP=Type	Telemetry	
CP=SecHdrFlag	1	
CP=APID	7	
CP=SeqFlags	Unsegmented	
CP=SeqCount	3	
CP=PktLength	1249	
CST= Time	2025-07-22 15:59:09	
MSID001	four	
MSID002	one	
MSID004	000102030405060708090a0b0c0...	
MSID005	7	
MSID006	2	
MSID007	4923954431178418875	
MSID008	6.000000	
MSID009	53.125000	
MSID010	0	
MSID011	2	

Close

Figure 27 TrekCcsds.7 Packet Data Values



Name	Value	Status
CP=Version	0	S
CP=Type	Telemetry	S
CP=SecHdrFlag	1	S
CP=APID	7	S
CP=SeqFlags	Unsegmented	S
CP=SeqCount	29	S
CP=PktLength	1249	S
CST= Time	2025-07-22 15:59:35	S
MSID001	two	S
MSID002	three	S
MSID004	000102030405060708090a0b0c0...	S
MSID005	7	S
MSID006	-2	S
MSID007	2464388554683811993	S
MSID008	58.000000	S
MSID009	73.437500	S
MSID010	0	S
MSID011	20	S

Figure 28 TrekCcsds.7 Display with Stale Data

28. In order to close the data recording file, select the Packet 7 Service in the Main Window and then go to the Service menu and select **Stop Recording**. This will stop the data recording and close the data recording files. You should see the following types of files in the trek_workspace recorded_data directory:

Packet 7_2025-05-10_21~24~59
 Packet 7.con

The Packet 7_2025-05-10_21~24~59 file is the file that contains the recorded data. The filename consists of a Start Time (the time associated with the first packet in the file) and the Base Filename you provided when you set up the service.

The Packet 7.con file is a configuration file that provides information about the contents of the data recording file. It is important to keep this file in the same directory with the data recording file since it is used by the TReK Playback application during data playback.

Congratulations – you have successfully completed the Tutorial!